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ABSTRACT

The RT-11 FORTRAN IV Installation Guide contains the procedures for installing FORTRAN IV and focuses special attention on installing the OTS in RX01 systems. This document describes the minimal system requirements, the files distributed in the kits, the options available for planning and configuring the system to user needs and system build verification. The appendices present a further treatment of material covered in the guide. In particular, Appendix F provides the user with a method for obtaining quick responses from DEC on specific software problems.

RT-11 FORTRAN IV Installation Guide

Order No. AA-5240B-TC

SUPERSESSION/UPDATE INFORMATION:

This document supersedes the RT-11 FORTRAN IV V1C Release Notes manual (DEC-11-LFRNA-A-D) for Version 2 of RT-11 FORTRAN. The release notes document is still valid for RT-11 FORTRAN IV V1C. Changes from the previous issue of this guide are indicated by change bars (█).

OPERATING SYSTEM AND VERSION:

RT-11 V03

SOFTWARE VERSION:

FORTAN IV V02

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DOCUMENTATION CONVENTIONS

All monitor and system program command lines are terminated by pressing the RETURN key. Since this is a non-printing character, at certain places in the text the notation RET represents the RETURN key.

In examples of keyboard dialogue, user input is underlined, but monitor output and program output are not.

In format descriptions, uppercase characters represent information that must be entered exactly as shown; lowercase characters represent variable information that must be supplied by the user.

Some special keyboard characters require that the CTRL (control) key be pressed simultaneously with a second character. These characters are denoted by ↑ (up arrow); for instance, ↑Z (CTRL Z).

Ellipsis marks (...) indicate one or more words were eliminated within a passage but without altering the meaning of the passage.

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1.0 INTRODUCTION

This installation guide provides you with the step-by-step instructions you need to install the FORTRAN IV compiler and Object Time System (OTS) in the RT-11 operating system. This information is predicated on a booted and running RT-11 system. Table 1 lists the sources of additional information you might find useful in building your FORTRAN IV system.

Table 1
Where to Find More Information

Subject	Source of Information
Blank disk formatting	Appendix B, SGM
Bootstrapping	Appendix A, SGM
Configuring (creating) a minimal system device	Chapter 2, SGM
VIRTUAL arrays	Appendix D, LRM
Key: SGM - RT-11 System Generation Manual LRM - PDP-11 FORTRAN Language Reference Manual	

1.1 Installation Errors

If you make errors within an installation section, go back to the beginning of the section and repeat the steps. Correct any typing errors by using the standard RT-11 input techniques RUBOUT and CTRL/U.

1.2 Installation Requirements

The following steps are required for a successful installation.

- a. Select the installation options
- b. Prepare to install
- c. Copy files from the distribution media to the system device (MT only)
- d. Select the compiler defaults
- e. Build the compiler
- f. Build the OTS
- g. Verify (system build and test)

1.3 System Requirements

The software included in this distribution requires the following system components for normal use.

RT-11 Version 3 Single Job (SJ), Foreground/Background (FB),
or Extended Memory (XM) monitor

PDP-11 processor (any)

Minimum 8K words of memory for installation and compilation.

The baseline SJ monitor is required for FORTRAN installation if the hardware configuration provides only 8K words of memory. See Appendix G for instructions on installing FORTRAN in an 8K system.

Minimum 135-209 contiguous blocks for compiler .SAV image.

Minimum 130-180 contiguous blocks for the OTS library.

These space requirements must be observed carefully in RX01 operating systems because they require special OTS installation procedures.

1.4 Distribution Files

The FORTRAN IV, Version 2, software is supplied on the following media.

- 1 RL01 disk cartridge
- 1 RK05 DECpack
- 1 RK06 disk cartridge
- 2 RX01 diskettes
- 2 TU56 DECTapes
- 1 7-track magnetic tape
- 1 9-track magnetic tape

All distribution media must be WRITE PROTECTED or WRITE LOCKED, as applicable to disk or tape. Be sure that no write ring is inserted at the back of the tape reel. Make certain, if the tape is TM-11, that the magtape is positioned at the load point. If it is not, rewind it manually.

1.4.1 File Contents

See Appendix A.

1.4.2 Adapting Your System Device for FORTRAN IV

Before you build the FORTRAN IV system, the RT-11 operating system must have been copied onto the target medium which becomes now your system device. You will need to make room for FORTRAN IV if your system medium is DECTape, single platter RF11 disk, single platter RJS03/4 disk, or floppy disk. The process you must follow to create a minimal system device is detailed in Chapter 2 of the RT-11 System Generation Manual and in Section 3.1 of this guide. This process is not required if your operating system device is RL01, RK05, RP02, RP03, RK06, multiple platter RF11 or multiple platter RJS03/04.

2.0 INSTALLATION OPTIONS

At installation time, the RT-11 operating system will engage you in an interactive dialog by means of system prompts. Your replies to the FORTRAN installation program's questions will determine your default library, the kind of code the compiler generates, match the available code to your interfacing hardware configuration, including hardware options, and other options and parameters available at installation time. Examples of the system's prompts are shown in Appendix B.1 for compiler installation and in B.2 for OTS installation.

Various options and parameters are available at installation time for your particular site. Prior to actual installation you must decide on your default system. The RT-11 FORTRAN System Subroutines (SYSF4) is a collection of routines provided on the distribution media as a file of concatenated object modules (SYSF4.OBJ). These modules interface with and can be called directly by FORTRAN thus allowing you as a FORTRAN user to utilize certain features of the RT-11 SJ and FB monitors as well as utility functions. You can create a library by using the Librarian to transform SYSF4 into a library file (SYSLIB). If this file (SYSF4) is linked directly with the FORTRAN program, all SYSLIB modules will be included even though not all are used. When SYSLIB is used in a default system library, it becomes SYSLIB.OBJ and the Linker uses it to resolve undefined globals. SYSLIB.OBJ is then resident on the system device (SY:). In addition to SYSF4 and FORLIB, SYSLIB.OBJ can also include user routines that you have written. This process is covered in detail in this chapter.

2.1 FORTRAN IV Compiler Installation Options

When you install the FORTRAN IV compiler you can make the following parameter changes which will be patched into the compiler .SAV image by the installation program FORGEN.SAV.

2.1.1 Listing Page Size

The compiler, as supplied, is set to a maximum of 56₁₀ lines per page for the compilation listing. You can change this parameter to any value greater than 0 for non-standard line printers.

2.1.2 Record Size

You can change the default maximum formatted record size for run-time I/O, allocated at 136₁₀ characters (bytes) to any new value between 4 and 4095 (inclusive). You can override the default value at compile-time by using the /RECORDSIZE:n compiler command option.

2.1.3 Number of Logical Channels

This parameter specifies the default maximum number of logical channels which can be open simultaneously under a FORTRAN IV program. The compiler, as supplied, pre-sets this value to 6 for the allocation of file descriptor blocks at run-time. This value must be in the range 1-15 inclusive. You can change it at compile time by using the /UNITS:n compiler command option.

2.2 Keywords and Options

Several keywords and options of the FORTRAN IV OPEN and CLOSE statements are valid only for specific operating systems and apply uniquely to the file services of the given system. These are covered in detail in the RT-11/RSTS/E FORTRAN IV User's Guide. You can use the RSTS/E switch /X:xxx (cross compile) to specify which one of three systems you are selecting for your FORTRAN IV program. The values are:

RT (for RT-11)
RST (for RSTS/E)
RSX (for RSX-11)

The default value for this switch is RT. You can set this value at installation time to any of the three values and can override it at compile time on a per program unit basis by invoking FORTRAN with the RUN command and using the RSTS/E /X switch.

2.3 Compiler Generated Code

The FORTRAN IV compiler produces both threaded code and inline code. You can select either or both at installation time. Threaded code consists of the addresses of routines which are invoked by FORTRAN to perform specified actions without any need for recompilation. Inline code consists of OTS modules which interface with and drive designated arithmetic hardware. Inline code interfaces with the following hardware options:

FP11	Floating Point Processor	(FPU)*
Kell-A,B	Extended Arithmetic Element	(EAE)
Kell-E	Extended Instruction Set	(EIS)
Kell-F	Floating Instruction Set	(FIS) and (EIS)
KEV11	Extended Arithmetic Chip	(EIS, FIS or THR)

Table 2 correlates inline code to the type of hardware option it interfaces.

Table 2
OTS Module/Hardware Option

OTS FILE	HARDWARE OPTION									PROCESSOR
	FP11-A or	FP11-B or	FP11-C	KE11-E	KE11-F	KEV11	KE11-A or	KE11-B	NONE	
* FPU	Y	Y	Y							PDP-11/70, 11/60, 11/55, 11/50, 11/45, 11/34
FIS				Y						PDP-11/40, 11/35
					Y					LSI-11 or 11/03
EIS	N	N	N							PDP-11/70, 11/60, 11/55, 11/50, 11/45, 11/34
			Y							PDP-11/40, 11/35, or 11/20
EAE						Y	Y			11/20, 11/15, 11/10
NHD								Y		ANY

N = NO
Y = YES

*Note that the FORTRAN compiler does not generate inline code for FPU, but inline code for EIS or FIS can interface with the OTS FPU library.

Inline code generally produces superior run-time results in terms of faster execution speed and minimal program size. You can take advantage of any arithmetic hardware by changing the default type code (threaded) supplied with the compiler. You can override the default selected at installation time by using the /CODE:xxx compiler command option at compile time.

2.3.1 Speed or Size Optimization for Inline Code

You have the option of optimizing for either speed or size when the inline compiler generates certain code sequences. Your selection of one excludes the other. When you choose optimization for size, floating point code sequences can be as much as four times smaller, but can take longer to run because OTS routines are called to pass floating point values on the stack. You will find that optimization for speed is beneficial where your program does not need to be minimized for size and does not require many floating point operations. You select the default optimization at installation time but you can override at compile time as follows:

To optimize for size, use
/NOOPTIMIZE:SPD compiler command option

To optimize for speed, use
/OPTIMIZE:SPD compiler command option

2.3.2 Compiler Build Selection

When you select your default code, the system will prompt you for your choice of a copy of a threaded only compiler, or an inline only, or both. In effect, the system offers you a full compiler (both codes) or a streamlined compiler (one code only). Your intended use of the system will determine your choice. If you anticipate that you will use the default code selector all the time, you will choose to save space on the system device by accepting the streamlined compiler. The approximate sizes of each of the three compilers are:

Threaded only	135 blocks
Inline only	180 blocks
Full compiler	209 blocks

If you decide to have the compiler generate only inline code, you can optimize the FORTRAN OTS for smaller size by omitting the two modules V2S and V2NS. Only the threaded compiler references these modules hence they are superfluous to the inline compiler. Conversely, if you select the threaded code compiler, you should direct that one -- but not both -- be built into the FORTRAN OTS. V2S modules check subscripts to determine whether an array subscript reference is within the bounds of the program. V2NS modules do not check array subscripts and are used when bounds checking is not desired.

2.4 OTS Library Installation Options

Your choice of OTS options is determined by your intended use of the system, the amount of storage available for your program and your programming practices. The FORTRAN installation program will prompt for your selection of OTS modules, specify the configuration requirements

for their inclusion, and define those modules which are not applicable to your particular installation. Some OTS modules run only on certain hardware and are therefore selected for assembly in accordance with those configurations. Refer again to Table 2.

The OTS installation procedure generates one default FORTRAN OTS library and any number of alternate OTS libraries which can be tailored for different services. Usually, only the default library is needed for FORTRAN operation.

2.4.1 SYSLIB or FORLIB Decision

Although the OTS normally is installed into the default system library SYSLIB.OBJ, you can direct the placing of the OTS into its own individual file FORLIB.OBJ. This separates FORLIB.OBJ from the other routines in the system library. When you place the OTS in SYSLIB, the Linker automatically searches SYSLIB to resolve any undefined global references. However, if SYSLIB contains user-written routines which are linked with non-FORTRAN programs more often than the FORTRAN OTS is linked with FORTRAN programs, your better option is the separate FORLIB.OBJ. In addition, your selection of SYSLIB and a separate FORLIB could decrease the SYSLIB search time the Linker requires for non-FORTRAN programs. You also have the choice of combining all the user-written routines, if there are many, into a third and separate library.

2.4.1.1 RT-11 Constraints - Unless your system is subject to file storage constraints, your operation will benefit when you add the OTS modules to SYSLIB, thus forming the file SY:SYSLIB.OBJ. However, if your OTS library must reside on a separate device, you will build the separate file FORLIB.OBJ.

NOTE

When you add the OTS modules to SYSLIB, the installation program assumes the existence of file SY:SYSLIB.OBJ.

2.4.2 VIRTUAL Support

FORTRAN IV supports the use of VIRTUAL arrays on PDP-11 processors equipped with the KT11 Memory Management Unit. See the PDP-11 FORTRAN Language Reference Manual for a description of VIRTUAL and the RT-11/RSTS/E FORTRAN User's Guide for some applications of VIRTUAL. RT-11 supports VIRTUAL under the SJ and FB monitors and under the XM monitor. Since the routines differ, under the SJ/FB monitors, from those for the XM monitor, you must decide which library will support VIRTUAL. Programs using VIRTUAL arrays linked with a library for the SJ/FB monitors cannot run under the XM monitor. The converse is also true.

However, if your FORTRAN IV program uses VIRTUAL arrays and is run under both the SJ/FB and the XM monitors you must generate an alternate library. In this case you should cause two .SAV images of the program to be made -- one linked with an SJ/FB VIRTUAL library, the other linked with an XM VIRTUAL library.

2.4.3 RUNTIME Bounds Checking for Threaded Code

The FORTRAN OTS includes the option of run-time array subscript checking for compiler-generated threaded code. Refer to 2.3.2.1 on the subject of modules V2S and V2NS. If you have included V2S into your OTS, every destructive array reference made by a program linked to the library is checked to insure that the element to be stored is within program bounds.

Your decision whether to use these OTS modules will be determined by the following considerations:

1. The check insures only that the referenced element is within program bounds -- not array bounds. //

The user program, including OTS routines, could be corrupted if the reference subscript exceeds the bounds of the array.

2. Program execution time could be slower because of the extra overhead involved in checking accesses to arrays.
3. Only non-VIRTUAL arrays are checked. See 2.3.

2.5 OTS Support for Optional Arithmetic Hardware

The FORTRAN installation program determines what optional arithmetic hardware is present on your system configuration and prompts you for your choice of OTS object modules to interface with the hardware options. You can obtain increased FORTRAN performance by choosing the appropriate OTS support for this interface. The installation prompts for the OTS options during the configuration of the default OTS library for SYSLIB or, alternatively, FORLIB. Your "NO" answer to a prompt allows you to choose a different type of hardware support. If you are building alternate FORTRAN OTS libraries, you must specify what type of hardware support they will include. The optional OTS object modules and their hardware interfaces are shown in Table 3. See also Table 2.

Table 3
OTS Module Interface with Hardware Options

OTS Module	Hardware Option Interface	
FPU	FP11	Floating Point Processor
EIS	KE11-E	Extended Instruction Set
FIS	KE11-F	Floating Instruction Set
	KEV11	Extended Arithmetic Chip
EAE	KE11-A,B	Extended Arithmetic Element
NHD	No specific arithmetic hardware (bare machine). Software performs the arithmetic operations.	

2.5.1 Stand Alone (\$SIMRT) Support Optimization

If you do not expect to use stand alone FORTRAN support, you can further optimize the FORTRAN OTS for smaller size by omitting UNI.OBJ from the OTS library.

3.0 INSTALLATION PROCEDURES

At this point you are ready to install the FORTRAN IV compiler and the FORTRAN OTS into your RT-11 system. The installation of each is covered in a separate section.

The devices you work with and their specifications are shown in Table 4.

Table 4
Device Identification

(n is the numerical designation of the drive unit)

Device	Device Specification
RK05	RKn:
RK06	DMn:
RP02 or RP03 disk	DPn:
RJS03/4 disk	DSn:
TC11 DECTape	DTn:
RX01 diskette	DXn:
TU16 magtape	MMn:
TU10 or TS03 magtape	MTn:
RF11 fixed head disk drive	RFn:
RL01 disk cartridge	DLn:

Note that if you install FORTRAN to floppy disk, be sure that the compiler is installed to target floppy 1 of 2, and that the OTS is installed to target floppy 2 of 2.

3.1 General Guidelines

The installation process consists of copying from the distribution media to the target (system) media. In some cases, the compiler and the OTS will be installed on the same system device (SY:). In other cases the compiler and the OTS will each be installed on two different devices. These latter are called "full" system devices and consist of the RL01 (DLn:), RK05 (RKn:), TC11 DECTape (DTn:) and RX01 floppy disk (DXn:). They are called "full" because they contain files which must be deleted to make room for FORTRAN. You require a minimum of 380 free blocks on your system device to build a FORTRAN system. You must retain the following files as a minimum.

xxMNyy.SYS*
TT.SYS
LP.SYS (if your system has a line printer)
DT.SYS (if the system is not DECTape)
EDIT.SAV
LIBR.SAV
LINK.SAV
PIP.SAV

*Substitute the SJ monitor appropriate to your system device; for example DXMNSJ.SYS for RX01 systems.

Section 2.3.2 of the RT-11 System Generation Manual details the procedures you must follow to build a system back-up for your FORTRAN installation. You will delete from the back-up those files you do not require when you make room for FORTRAN. The back-up device then becomes your system master and is treated with the same care as the distribution media.

Both the distribution media and the system back-up are removed after copying and stored in a safe place. Both must be WRITE LOCKed or WRITE PROTECTED when they are mounted and the write ring must be removed from a magtape reel. When you copy, you must WRITE ENABLE the system device. At installation the distribution medium is given the logical assignment to input (INP) and the system medium is assigned to output (OUP).

3.2 Installing the Compiler

Boot an RT-11 Version 3 monitor (SJ, FB or XM) with the required device handlers for the distribution and the target devices. Use the 8K monitor if the system configuration is for 8K words. Follow these procedures to insure a correct installation.

1. Assign the target physical device to OUP, for example:

ASSIGN RK0: OUP

2. Mount the distribution medium and make the physical to logical assignment for each different medium as follows:

- a. RL01 or RK05 distribution

Mount the distribution medium in a free RL01 or RK05 drive and assign the drive to input:

ASSIGN RKn: INP or ASSIGN DLn: INP

- b. RK06 distribution

Mount the distribution medium in a free RK06 drive and assign the drive to input:

ASSIGN DMn: INP

- c. Diskette (floppy disk) distribution

Two diskettes are supplied
You are working with two diskettes -- diskette 1 is for the compiler installation; diskette 2 for the OTS. Mount diskette 1 in a free DX drive and assign the drive to input:

Assign DX0: OUP
ASSIGN DXn: INP

*system
the h/z
mechanism
in 0*

*yellowed
diskette
in 1*

AS-5635A-BL

- d. DECTape distribution

You are working with two DECTapes -- DECTape 1 is for the compiler installation; DECTape 2 for the OTS. Mount DECTape 1 in a free TC11 drive and assign the drive to input:

ASSIGN DTn: INP

e. Magtape distribution

Mount the distribution tape on a free drive and assign the drive to input.

```
ASSIGN MTn: INP      (for TU10 drive)
ASSIGN MMn: INP      (for TU16 drive)
```

3. Invoke the installation indirect command files

a. Magtape distribution

Copy the installation indirect command file from the distribution tape to the system device, then invoke the file from the system device:

```
COPY INP:FORGEN.COM SY:
@FORGEN
```

b. RL01/RK05/RK06/Floppy disk/DECTape distribution

Invoke the installation indirect command file directly from the distribution medium:

```
@INP:FORGEN
```

Now the FORTRAN installation program and the indirect command files for installing the compiler will copy the required files to the output device (OUP) from the input device (INP). The installation program will next offer you options in the form of a question and answer dialog. See Appendix B.1 for a sample FORTRAN compiler dialog. Preserve these files as described in Section 5.4 (Preserving the FORTRAN IV System). Your replies will result in the generation of an indirect command file (FORBLD.COM) and an object file (OUP:DEFLT.S.OBJ).

3.3 Installing the FORTRAN OTS

You follow essentially the same procedures for installing the OTS as you did when you installed the FORTRAN compiler. Once again, in some cases the OTS will be built onto the same system device as the compiler (SY:); in others, the OTS will be built on a separate device. The separate devices for the OTS are the RK05 (RKn:), TC11 DECTape (DTn:) and RX01 floppy disk (DXn:). You build the system back-up from the distribution media and carefully preserve both when copying is complete. The system back-up will be used when you delete files, as described in Section 2.3.2 of the RT-11 System Generation Manual, to make room for FORTRAN. You must retain at least the same files as prescribed for the FORTRAN compiler in Section 3.1 of this guide. RX01 systems are an exception. See section 4 for the minimum files for RX01 OTS installation.

When you copy, both the distribution medium and the system back-up must be WRITE LOCKed or WRITE PROTECTed and the write ring must be removed from a magtape reel. For copying you must WRITE ENABLE the target device. As with the compiler installation, the distribution medium is given the logical assignment to input (INP) and the target medium is assigned to output (OUP). Follow these procedures to insure a correct OTS installation on all but RX01 systems. Follow the instructions of Section 4 for floppy disk OTS installation.

1. Assign the target physical device to OUP; for example,
ASSIGN RK0: OUP

2. Mount the distribution medium and make the physical to logical assignment for each different medium as follows:

- a. RL01/RK05 distribution

Mount the distribution device in a free RK05 or RL01 drive and assign the drive to input:

ASSIGN RKn: INP ASSIGN DLn: INP

- b. RK06 distribution

Mount the distribution device in a free RK06 drive and assign the drive to input:

ASSIGN DMn: INP

- c. Diskette (floppy disk) distribution

You are working with the second of two diskettes (you used the first for the compiler). Mount the distribution disk in DX drive 1 and mount system diskette 2 in a DX drive. Assign drive 1 to input:

ASSIGN DX1: INP
ASSIGN DX0: OUP

- d. DECTape distribution

You are working with the second of two DECTapes (you used the first for the compiler). Mount DECTape 2 in a free TC11 drive and assign the drive to input:

ASSIGN DTn: INP

- e. Magtape distribution

Mount the distribution tape on a free drive and assign the drive to input:

ASSIGN MTn: INP (for TU10 drive)
ASSIGN MMn: INP (for TU16 drive)

3. Invoke the installation indirect command files for all except RX01 systems. See section 4 for RX01 OTS installation procedures.

- a. Magtape distribution

Copy the installation indirect command file from the distribution tape to the system device, then invoke the file from the system device:

COPY INP: OTSGEN.COM SY:
@OTSGEN

- b. RL01/RK05/RK06/Floppy disk/DECTape distribution

Invoke the installation indirect command file directly from the distribution medium:

@INP:OTSGEN

Now the FORTRAN installation program and the indirect command files for installing the OTS will copy the required files to the output device (OUP) from the input device (INP). The installation program will next offer you options in the form of a question and answer dialog. See Appendix B.2 for a sample FORTRAN OTS dialog. Your replies will result in the generation of an indirect command file (OTS1.COM) for creating libraries. Preserve this file as described in Section 5.4 (Preserving the FORTRAN IV System).

4.0 RX01 DISKETTE INSTALLATION

The procedures for installing the second (OTS) diskette are significantly different from those for other systems.

- a. Do not use the indirect command file

OTSGEN.COM

- b. You install the OTS manually and you will need the following files as an absolute minimum:

SWAP.SYS
DXMNSJ.SYS
TT.SYS
PIP.SAV
LIBR.SAV

4.1 Copying the Files

Place FORTRAN distribution disk number 2 (OTSCOM) in drive 1 and the system (target) disk in drive 0. Make the following assignments:

ASSIGN DX1: INP
ASSIGN DX0: OUP

Then:

.RUN INP:OTSGEN

Respond to the questions posed by the OTS installation program. This will place the indirect command file OTS1 on the assigned output device (OUP:). Now you must implement your decision (see 2.4.1) either to include FORLIB in SYSLIB or to have a separate FORLIB. If you had decided to incorporate the OTS into SYSLIB, the OTS1 you create might look like this (XXX represents an OTS inline code module):

.R LIBR
SYSLIB=SYSLIB,OUP:XXX/U,OTSCOM/U,NOVIR/U,V2NS/U/G
\$ERRS
\$ERRTB
\$VRINT
^C

If you are installing a separate FORLIB, OTS1 might look like this:

.R LIBR *F15*
FORLIB=OUP:XXX/U,OTSCOM/U,NOVIR/U,V2NS/U/G
\$ERRS
\$ERRTB
\$VRINT
^C

4.2 Editing the OTS onto the Second Diskette

Now edit the file as follows: Change OUP: to INP: in the above command lines.

If you are building SYSLIB for the first time, delete the second occurrence of SYSLIB.

4.2.1 Allocating Diskette Space for the OTS

Be sure there are at least 180 contiguous free blocks on the output device, then make one of the following changes:

Change SYSLIB to SYSLIB[180]; or,
Change FORLIB to FORLIB[180];

in accordance with your choice of a default library. This allocates 180 blocks to either SYSLIB or FORLIB, which should be adequate. If you find it necessary, squeeze the disk.

When you have completed these operations, the edited file should appear as:

```
.R LIBR
SYSLIB[180]=INP:XXX/U,OTSCOM/U,NOVIR/U,V2NS/U/G
.
.
.
.
```

or

```
.R LIBR
FORLIB[180]=INP:XXX/U,OTSCOM/U,NOVIR/U,V2NS/U/G
```

Finally, execute the file by entering:

@OTS1

The new library now will be on the output device.

5.0 INSTALLATION VERIFICATION

The final stage in the installation of FORTRAN IV into your RT-11 operating system is verification -- a test to demonstrate that FORTRAN has been correctly installed and is working. You verify by compiling the sample program (DEMO.FOR), linking it and executing it. See Appendix B.3 for a sample listing of DEMO.FOR.

5.1 Compiling

When FORTRAN is built on the system device (SY:), compile by using the keyboard monitor COMPILE or FORTRAN command:

COMPILE INP:DEMO

When FORTRAN is built on other than the system device, be sure that the device handler for OUP is loaded:

LOAD DM

if the system device is RK05 and FORTRAN was built on an RK06.

Then issue the command:

```
RU OUP:FORTRA  
*DEMO=DEMO  
*↑C
```

5.2 Linking

If you have built FORLIB into SYSLIB, issue the command:

```
LINK DEMO
```

If you have built a separate FORLIB issue either command:

```
LINK DEMO,FORLIB
```

or

```
LINK DEMO/LINKLIBRARY:FORLIB
```

5.3 Executing

To execute the demonstration program, issue the command:

```
RUN DEMO
```

5.4 Preserving the FORTRAN IV System

Having verified the installation, your next step is to preserve the FORTRAN IV system. Do this by copying the necessary files of the FORTRAN system to a file structured (specifically, not magtape) device. This facilitates changing compiler defaults and applying patches to the FORTRAN system. Remember that if the back-up is DT or DX, there will be two such devices: the first for the compiler, the second for the OTS. The following files as shown in Table 5 comprise the FORTRAN system:

Table 5
FORTRAN System Files

COMPILER FILES		OTS FILES
DT1 or DX1		DT2 or DX2
OUP: DEFLT.S.OBJ	INP: CONVRT.OBJ	OUP: OTS1.COM
INP: FROOT.OBJ	INP: REGALO.OBJ	INP: NHD.OBJ
INP: F0.OBJ	INP: F21.OBJ	INP: EAE.OBJ
INP: F1.OBJ	INP: F19.OBJ	INP: EIS.OBJ
INP: F2.OBJ	INP: PEEP.OBJ	INP: FIS.OBJ
INP: F3.OBJ	INP: OBJGSD.OBJ	INP: FPU.OBJ
INP: F4.OBJ	INP: F18.OBJ	INP: OTSCOM.OBJ
INP: F5.OBJ	INP: F13.OBJ	INP: V2S.OBJ
INP: F6.OBJ	INP: F15.OBJ	INP: V2NS.OBJ
INP: F7.OBJ	INP: F16.OBJ	INP: NOVIR.OBJ
INP: F8.OBJ	INP: F17.OBJ	INP: VIRP.OBJ
INP: F9.OBJ	INP: F4LINK.COM	INP: VIRNP.OBJ
INP: F10.OBJ	INP: F4LTHR.COM	INP: UNI.OBJ
INP: LOOP.OBJ	INP: F4LINL.COM	INP: OTSGEN.SAV
INP: F11.OBJ	INP: FORGEN.SAV	
INP: F12.OBJ	OUP: FORBLD.COM	

APPENDIX A
DISTRIBUTION FILES

The distribution media contain the following FORTRAN files.

A.1 Compiler Files

FORGEN.COM	Compiler installation command file
FROOT.OBJ	
F0.OBJ	
F1.OBJ	
F2.OBJ	
F3.OBJ	
F4.OBJ	
F5.OBJ	
F6.OBJ	
F7.OBJ	
F8.OBJ	
F9.OBJ	
F10.OBJ	
LOOP.OBJ	
F11.OBJ	
F12.OBJ	
F13.OBJ	
F14.OBJ	
F15.OBJ	
F16.OBJ	
F17.OBJ	
CONVRT.OBJ	
REGALO.OBJ	
F21.OBJ	
F19.OBJ	
F20.OBJ	
PEEP.OBJ	
OBJGSD.OBJ	
F18.OBJ	
INLINE.OBJ	
THREAD.OBJ	
F4LINK.MT	These appear only on the magtape distribution
F4LTHR.MT	
F4LINL.MT	
F4LINK.COM	
F4LTHR.COM	
F4LINL.COM	
FORTRA.HLP	Compiler help file

DEMO.FOR
FORGEN.SAV

Installation verification program
Compiler installation program

A.2 OTS Library Files

These files are distributed on a second tape or diskette in the TU56 DECTape and RK01 Diskette kits.

OTSGEN.COM

OTS library installation command file

The following OTS object modules:

EIS.OBJ
EAE.OBJ
FIS.OBJ
FPU.OBJ
NHD.OBJ
UNI.OBJ
VIRNP.OBJ
VIRP.OBJ
NOVIR.OBJ
V2NS.OBJ
V2S.OBJ
OTSCOM.OBJ
OTSGEN.SAV

OTS library configuration program

APPENDIX B

FORTRAN IV INSTALLATION PROGRAM

B.1 Compiler Installation Program

The following listing is a sample of the installation program dialog for compiler installation.

ASS RK0 OUP

.ASS RK1 INP

.@INP:FORGEN

.R PIP

SY:.*=INP:FORTRA.HLP,DEMO.FOR,F4L*.COM

*^C

.RU INP:FORGEN

Answer questions with:

"?" or carriage return (<CR>) for information,

YES(Y) for affirmation, anything else for NO.

A maximum of 56 lines are allowed per listing page.

Is this acceptable? Y

A maximum of 136 characters are allowed in a formatted (ASCII) record. Is this acceptable? N

Type the new value (must be greater than 3 and less than 4096) : 83\3\4

A maximum of 6 channels may be open at a given time.

Is this acceptable? N

Type the new value (must be greater than 0 and less than 16) : 10

The FORTRAN compiler can compile system-specific OPEN and CLOSE statement keywords for RT-11, RSX-11, and RSTS/E systems. These statements are currently compiled for the following system: RT-11

Is this acceptable? Y

FORTRAN can produce inline code for EAE, EIS or FIS hardware, or it can produce threaded (THR) code which is hardware independent.

Should the compiler produce EAE code? N

Should the compiler produce EIS code? Y

The inline compiler can optimize for SPEED or for SIZE. These optimizations are mutually exclusive. Do you want the optimization to be for SPEED? N\N\

Answer NO if the other optimization should be performed.

The inline compiler can optimize for SPEED or for SIZE. These optimizations are mutually exclusive. Do you want the optimization to be for SPEED? Y

Do you wish an inline only compiler? Y

Compiler options selection complete.

.@FORBLD

.@F4LINL

.R LINK

```
*OUP:FORTRA=INP:FROOT//S
*INP:F0,THREAD,OUP:DEFLT/0:1
*INP:F1/0:1
*INP:F2/0:1
*INP:F3/0:1
*INP:F4/0:1
*INP:F5/0:1
*INP:F6/0:1
*INP:F7/0:1
*INP:F8/0:1
*INP:F9/0:1
*INP:F10/0:1
*INP:LOOP/0:1
*INP:F11/0:1
*INP:F12/0:1
*INP:CONVRT/0:1
*INP:REGALO/0:1
*INP:F14/0:1
*INP:F20/0:1
*INP:F19/0:1
*INP:F21/0:1
*INP:PEEP/0:1
*INP:OBJGSD/0:1
*INP:F18/0:1
*INP:CDUMP/0:1//
*~C
```

.DEL SY:F4L*.COM/NOQ

B.2 OTS Installation Program

The following listing is a sample of the installation program dialog for the OTS installation.

.ASS RK0 OUP

.ASS RK1 INP

.@INP:OTSGEN

.R PIP

```
*OUP:EIS.OBJ=INP:EIS.OBJ
*OUP:EAE.OBJ=INP:EAE.OBJ
*OUP:FIS.OBJ=INP:FIS.OBJ
*OUP:FPU.OBJ=INP:FPU.OBJ
*OUP:NHD.OBJ=INP:NHD.OBJ
*OUP:UNI.OBJ=INP:UNI.OBJ
*OUP:VIRNP.OBJ=INP:VIRNP.OBJ
*OUP:VIRP.OBJ=INP:VIRP.OBJ
*OUP:NOVIR.OBJ=INP:NOVIR.OBJ
*OUP:V2NS.OBJ=INP:V2NS.OBJ
*OUP:V2S.OBJ=INP:V2S.OBJ
*OUP:OTSCOM.OBJ=INP:OTSCOM.OBJ
*~C
```


.RU INP:OTSGEN

Answer questions with:

"?" or carriage return (<CR>) for information,
YES(Y) for affirmation, anything else for NO.

The following questions refer to the building of the
default FORTRAN library.

The FORTRAN library components are normally added to
the default system library, SYSLIB.OBJ.

Is this acceptable? Y

The default FORTRAN library will be found in the file SYSLIB.OBJ.

The default FORTRAN library will be configured for the
EIS hardware found on this machine. Is this acceptable? Y

Is support for VIRTUAL arrays desired? N

Do you wish an inline only library? Y

Do you wish SIMRT support in your library? N

The default FORTRAN library has been configured.

Are any other FORTRAN libraries required? N

STOP ---

.@OTS1

.R LIBR

*SYSLIB=SYSLIB,OUTP:EIS/U,OTSCOM/U,NOVIR/U/G

Global? \$ERRS

Global? \$ERRTB

Global? \$VRINT

Global?

*^C

.DEL OUTP:(EIS,EAE,FIS,FPU,NHD,UNI).OBJ/NOQ

.DEL OUTP:(VIRNP,VIRP,NOVIR,V2NS,V2S,OTSCOM)/NOQ

B.3 Installation Verification Program

The following listing is an example of the FORTRAN verification pro-
gram DEMO.FOR.

.R DEMO

***** RT11 FORTRAN IV V2 DEMONSTRATION TEST *****

INSTALLATION SUCCESSFUL IF NO ERROR MESSAGES
WERE PRINTED ABOVE.

**** FORTRAN DEMONSTRATION TEST COMPLETE ****

.

Page 100
The first part of the report
is devoted to a description of the
method used in the investigation.

The results of the investigation
are presented in the following
table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

The results of the investigation
are presented in the following
table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

The results of the investigation
are presented in the following
table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

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the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

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number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

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are presented in the following
table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

The results of the investigation
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table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

The results of the investigation
are presented in the following
table. The first column gives the
number of cases, the second column
gives the number of cases in which
the disease was found to be
infectious, and the third column
gives the number of cases in which
the disease was found to be
non-infectious.

APPENDIX C

FORTRAN OTS

C.1 Assembling the OTS from Sources

This appendix applies to the source version of the FORTRAN OTS as supplied in the RT-11 source kits. The sources are kept on logical device SRC: and listing and map files are output to LST:.

You must modify BUILDF.COM to make the proper assignments for SRC:, LST:, and OBJ:. Remember that the sources must be on SRC: which must be file structured -- that is, you cannot use magtape. The object files will be directed to OBJ: which also must be file structured, again ruling out magtape. Listing files will be directed to LST: but if you do not want listings, assign the null device to LST:.

ASSIGN NL LST

If you find it necessary to install the NL handler before you do this assign, use the monitor INSTALL command:

INS NL:

You can use magtape for the listings.

APPENDIX D
CHANGING COMPILER DEFAULTS

You can change the compiler defaults by following these steps:

1. Mount the back-up device you created for compiler installation on a free drive and assign it to input (INP). If the device is DECTape or floppy disk it is 1 of 2 (the OTS is 2 of 2). If the device is DECTape, the monitor ASSIGN command becomes:

ASSIGN DTn: INP

2. Assign the target device to output (OUP). Assuming the system device to be RKn:, enter the monitor ASSIGN command

ASSIGN RKn: OUP

3. Next:

RUN INP:FORGEN

4. Then:

@FORBLD

5. Finally copy OUP:DEFLT:OBJ and FORBLD.COM to INP by entering the command:

COP OUP:DEFLT:OBJ INP:
COP OUP:FORBLD.COM INP:

APPENDIX E
COMPILER PATCHES

E.1 Follow these procedures for applying compiler patches:

- a. Mount the back-up device you created for the compiler installation on a free drive. This will be device 1 of 2 for DEctape or floppy disk.
- b. Assign the device to INP:. Assuming DEctape, use the monitor ASSIGN command

ASSIGN DTn: INP

- c. Assign the target device to OUP. Assuming RK05, use the monitor ASSIGN command

ASSIGN RKn: OUP

- d. Copy the file DEFLTS.OBJ from INP to OUP.

COP INP: DEFLTS.OBJ OUP

- e. Follow the directions in the patch and apply the patch.
- f. Build the compiler:

@INP:FORBLD

- g. Copy any modified .OBJ or .COM files created by the patch to INP

E.2 Follow these procedures for applying OTS patches:

- a. Mount the back-up device you created for the OTS installation on a free drive. This will be device 2 of 2 for DEctape or floppy disk.
- b. Assign the device to INP. Assuming DEctape, use the monitor ASSIGN command

ASSIGN DTn: INP

- c. Assign the target device to OUP. Assuming RK05, use the monitor ASSIGN command

ASSIGN RKn: OUP

- d. Follow the directions in the patch and apply the patch.
- e. Build the OTS as follows:

If you are not adding more OTS modules to the OTS built at installation time, enter the command

@INP:OTS1

otherwise:

Enter the command

RUN INP:OTSGEN

Then:

COP OUP:OTS1.COM INP

Finally:

@INP:OTS1

APPENDIX F
PROBLEMS/BUGS

1. To obtain quick and accurate answers to the problems and bugs you might encounter, include the following with your Software Performance Report (SPR).

- a. Problem: Compiler generates a crash dump.

Your action: Send a copy of your program on a machine readable medium if the program is larger than one disk block. Also, send the console output and indicate what compiler installation options are available for your configuration and indicate what options you selected for the compilation that aborted.

- b. Problem: Compiler generates incorrect code (program does not work or traps at run-time).

Your action: Send a copy of your program on a machine readable medium if the program is larger than one disk block. Include any required data files on a machine readable medium. Also, send the console output and indicate:

1. What compiler options were selected.
2. What OTS installation options were selected.

APPENDIX G

NOTES ON INSTALLING FORTRAN ON 8K SYSTEMS

G.1 Installing the Compiler

1. Follow steps 1 and 2 of Section 3.2 of this manual.
2. Print the contents of the file INP:FORGEN.COM on the terminal.

TYPE INP:FORGEN.COM

3. Type the contents of the file INP:FORGEN.COM down to but not including the line which reads

@FORBLD

Note that as you run INP:FORGEN, the installation program will ask you questions about your system requirements. Answer these questions.

4. Print the contents of the file FORBLD.COM

TYPE FORBLD.COM

This file will reference one of the following three files: F4LINK.COM, F4LINL.COM, or F4LTHR.COM.

5. Print the contents of the file referenced in step 4.

TYPE F4L???COM

6. Type the contents of the file as printed in step 5.
7. Type the remainder of the file INP:FORGEN.COM after the line which reads

@FORBLD

G.2 Installing the OTS

1. Decide which of the following five arithmetic modules is suitable for your configuration (Refer to Section 2.5 if you are not certain):

NHD, EAE, EIS, FIS, FPU

In the subsequent Librarian Command String, this module will be referred to as XXX.

2. Decide which of the following two subscripting modules is required for your application. Refer to Section 2.4.3 if you are uncertain. Note that this module is optional (unnecessary) for an inline-only library.

V2S, V2NS

In the subsequent Librarian Command String, this module will be referred to as SSSS.

3. Decide whether stand-alone support (UNI.OBJ) is required.
4. Decide whether FORLIB should be incorporated into SYSLIB or not. (See Section 2.4.1 of this manual.)
5. Creating the OTS library.

- a. FORLIB is to be incorporated into SYSLIB.

```
.R LIBR  
*SYSLIB=SYSLIB,INP:XXX,OTSCOM,NOVIR[,SSSS][,UNI]/G  
Global? $ERRS  
Global? $ERRTB  
Global? $VRINT  
Global? <RET>
```

- b. FORLIB is not to be incorporated into SYSLIB.

```
.R LIBR  
*FORLIB=INP:XXX,OTSCOM,NOVIR[,SSSS][,UNI]/G  
Global? $ERRS  
Global? $ERRTB  
Global? $VRINT  
Global? <RET>
```


READER'S COMMENTS

NOTE: This form is for document comments only. DIGITAL will use comments submitted on this form at the company's discretion. Problems with software should be reported on a Software Performance Report (SPR) form. If you require a written reply and are eligible to receive one under SPR service, submit your comments on an SPR form.

Did you find errors in this manual? If so, specify by page.

Did you find this manual understandable, usable, and well-organized? Please make suggestions for improvement.

Is there sufficient documentation on associated system programs required for use of the software described in this manual? If not, what material is missing and where should it be placed?

Please indicate the type of user/reader that you most nearly represent.

- ☐ Assembly language programmer
- ☐ Higher-level language programmer
- ☐ Occasional programmer (experienced)
- ☐ User with little programming experience
- ☐ Student programmer
- ☐ Non-programmer interested in computer concepts and capabilities

Name _____ Date _____

Organization _____

Street _____

City _____ State _____ Zip Code _____

or
Country

Please cut along this line.

-----Fold Here-----

-----Do Not Tear - Fold Here and Staple-----

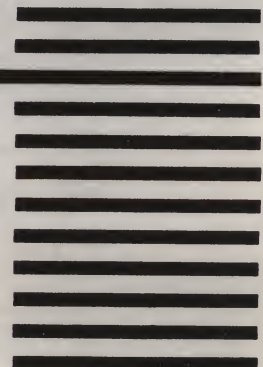
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.RU INP:FORGEN
ANSWER QUESTIONS WITH:
"?" OR CARRIAGE RETURN (<CR>) FOR INFORMATION,
YES(Y) FOR AFFIRMATION, ANYTHING ELSE FOR NO.

A MAXIMUM OF 56 LINES ARE ALLOWED PER LISTING PAGE.
IS THIS ACCEPTABLE? Y

A MAXIMUM OF 136 CHARACTERS ARE ALLOWED IN A FORMATTED
(ASCII) RECORD. IS THIS ACCEPTABLE?

THIS VALUE CAN BE CHANGED ON A PER-PROGRAM BASIS WITH
THE "/R" COMPILER SWITCH. ANSWER NO TO CHANGE THE
PERMANENT DEFAULT VALUE.

A MAXIMUM OF 136 CHARACTERS ARE ALLOWED IN A FORMATTED
(ASCII) RECORD. IS THIS ACCEPTABLE? NO

TYPE THE NEW VALUE (MUST BE GREATER THAN 3 AND LESS THAN 4096) : 80

A MAXIMUM OF 6 CHANNELS MAY BE OPEN AT A GIVEN TIME.
IS THIS ACCEPTABLE? Y

THE FORTRAN COMPILER CAN COMPILE SYSTEM-SPECIFIC OPEN AND CLOSE
STATEMENT KEYWORDS FOR RT-11, RSX-11, AND RSTS/E SYSTEMS. THESE
STATEMENTS ARE CURRENTLY COMPILED FOR THE FOLLOWING SYSTEM: RT-11

IS THIS ACCEPTABLE? Y

FORTRAN CAN PRODUCE INLINE CODE FOR EAE, EIS OR FIS HARDWARE,
OR IT CAN PRODUCE THREADED (THR) CODE WHICH IS HARDWARE INDEPENDENT.

SHOULD THE COMPILER PRODUCE EAE CODE? NO

SHOULD THE COMPILER PRODUCE EIS CODE? NO

SHOULD THE COMPILER PRODUCE FIS CODE? Y

THE INLINE COMPILER CAN OPTIMIZE FOR SPEED OR FOR SIZE. THESE
OPTIMIZATIONS ARE MUTUALLY EXCLUSIVE. DO YOU WANT

THE OPTIMIZATION TO BE FOR SPEED? Y

DO YOU WISH AN INLINE ONLY COMPILER? Y

COMPILER OPTIONS SELECTION COMPLETE.

.@FORBLD

.@F4LINL

.R LINK

*OUP:FORTRA=INP:FROOT///5

*INP:F0,THREAD,OUP:DEFLT5/0:1

*INP:F1/0:1

*INP:F2/0:1

*INP:F3/0:1

*INP:F4/0:1

*INP:F5/0:1

*INP:F6/0:1

*INP:F7/0:1

*INP:F8/0:1

*INP:F9/0:1

*INP:F10/0:1

*INP:LOOP/0:1

*INP:F11/0:1

*INP:F12/0:1

*INP:CONVRT/0:1

*INP:REGALO/0:1

*INP:F14/0:1

*INP:F20/0:1

*INP:F19/0:1

*INP:F21/0:1

*INP:PEEP/0:1

*INP:OBJGSD/0:1

*INP:F18/0:1

*INP:CDUMP/0:1//

*^C

.DEL SY:F4L*.COM/NOQ

.ASS DX1: INF
.ASS DX2: OUP
.RAN WP: OTSGEN

THE FOLLOWING QUESTIONS REFER TO THE BUILDING OF THE
DEFAULT FORTRAN LIBRARY.

THE FORTRAN LIBRARY COMPONENTS ARE NORMALLY ADDED TO
THE DEFAULT SYSTEM LIBRARY, SYSLIB.OBJ.

IS THIS ACCEPTABLE? NO

THE DEFAULT FORTRAN LIBRARY WILL BE FOUND IN THE FILE FORLIB.OBJ.

THE DEFAULT FORTRAN LIBRARY WILL BE CONFIGURED FOR THE
FIS HARDWARE FOUND ON THIS MACHINE. IS THIS ACCEPTABLE? Y

IS SUPPORT FOR VIRTUAL ARRAYS DESIRED? NO

DO YOU WISH AN INLINE ONLY LIBRARY? Y $\leftarrow$

DO YOU WISH SIMRT SUPPORT IN YOUR LIBRARY?

ANSWER YES IF YOU INTEND TO GENERATE STAND ALONE PROGRAMS; THEY
REQUIRE SIMRT SUPPORT.

DO YOU WISH SIMRT SUPPORT IN YOUR LIBRARY? Y

THE DEFAULT FORTRAN LIBRARY HAS BEEN CONFIGURED.

ARE ANY OTHER FORTRAN LIBRARIES REQUIRED?

ANSWER YES TO BUILD ALTERNATE FORTRAN LIBRARIES.

ARE ANY OTHER FORTRAN LIBRARIES REQUIRED? N

STOP --

. R LIBR

*FORLIB=OUP:XXX/U, OTSCOM/U, NOVIR/U, V2NS/U/G

?LIBR-F-FILE NOT FOUND XXX

*^C

. TYPE OTS1.COM

R LIBR

OUP:FORLIB=OUP:FIS, OTSCOM/U, NOVIR/U, UNI/U/G

\$ERRS

\$ERRTB

\$VRINT

^C

niet met Edit gedaan zelf getypt

. R LIBR

*FORLIB[180]=INP:FIS, OTSCOM/U, NOVIR/U, INI/UNI/U/G 2

GLOBAL? \$ERRS

GLOBAL? \$ERRTB

GLOBAL? \$VRINT

GLOBAL? 2

*^C